THIRD ANNUAL REPORT

to the

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

on the

SPACE AND TECHNOLOGY TRANSFER PROGRAM

of the

University of Pittsburgh
Knowledge Availability Systems Center
May, 1967

Contract NASr-234

CONTENTS

I. Abstract

The regional dissemination center established at the University of Pittsburgh (at the Knowledge Availability Systems Center) has completed three years of operation. The organization consists of a trained cadre of engineering consultants and full time Center Staff, now serving sixty-four companies in the Northeastern part of the United States. Two of these companies exhibited classical transfers, in that products now offered for sale were developed as a result of membership in the program.

Center operations have been formalized to the point at which a predictive model could be developed leading to the conclusion that self-support may be achieved with an increase in fees of approximately 50% with approximately twice the current number of member companies. Accordingly, a new fee structure is being implemented, and marketing activities augmented to increase company membership.

II. Background

In April, 1963, the University of Pittsburgh established a new Knowledge Availability Systems Center with a charter to develop a program of research, operations, and teaching in the information sciences. In accordance with the Center's proposed operations, the University submitted a proposal to the National Aeronautics and Space Administration's Technology Utilization Division to establish a regional sub-system for the dissemination of aerospace information. In May, 1964, a contract (NASr-234) was let to the University's Knowledge Availability Systems Center to devise methods and to begin the implementation of a program designed to transfer aerospace innovations and technical information to the industrial community.

Eleven large manufacturing and public service organizations agreed initially to be served by the Pitt dissemination activity. During the first year of the KAS Center's interaction with its eleven original industrial members, methodologies for dissemination, management and data recording were developed.

During its second year of operation, May 1964 to April 1965, the base of fee-paying industrial participants was increased to fifty-three; the geographic area encompassed by the activity was expanded to encompass the Northeastern part of the United States; and a diversification in the size of companies being serviced was realized through the signing of many small and medium-sized organizations.

The KASC staff which participated in the Technology Transfer program was augmented greatly with the acquiring, on a part-time basis, of senior faculty members of the University's Graduate School of Engineering as active participants in dissemination, evaluation and consultation with member companies.

A full-time Marketing Director was hired, and the base of literature encompassed by the program was expanded to include USGDR, DOD, AEC and Government Patent Literature. A 100% increase in the number of problems being analyzed and serviced monthly by the Pitt-NASA activity was realized, with the total reaching 1,270 profiles in April, 1966. In addition, documentable transfers of technology from the aerospace literature to non-aerospace users were reported. Concurrently, research programs relating to the augmenting of user services and on facilitating file exploitation were begun, and a space-to-business-terminology thesaurus was initiated. Finally, certain members of the KAS staff were used as computer, management and information science consultants to the Technology Utilization Division Headquarters of the Space Administration.

III. Third Year Activities - A. New Memberships

The third year of the Technology Transfer Program at the University of Pittsburgh's KAS Center has continued the growth pattern exhibitied in the first two years of operation. Whereas, at the close of the second year, fifty-three industrial organizations were participating with the KAS Center in evaluating and applying of aerospace innovations and technical information, the close of the third year finds sixty-four organizations (60 fee-paying) participating in the Technology Transfer activity (See Appendix 1). Concurrent with this increase in the number of industrial participants, a corresponding increase in the dollar volume of membership fees which participating organizations contribute to the Technology Transfer Program has been realized. At the close of the third year of operation, industrial membership fees in the Pitt-NASA activity rose to the level of $97,050.00. Individual membership fees which are reflected in this total extend from a minimum of $500.00 to maximum of $8000.00 per year, based upon the volume and type of service provided to the participating organization.

B. Renewal of Memberships

One of the major concerns has been that of obtaining renewals from current fee-paying members. The desire to develop long-term relationships with industry was based upon three factors:

(1) past experience which has shown that there is a direct relationship between the length of time during which an organization participates in a Technology Transfer system, and the ability of that system to serve the clients precise needs. This phenomenon occurs partially as a result of the system's increasing sophistication and maturity, and partially through the user becoming accustomed to applying others' ideas in the solving of his own problems;

(2) a continuing user base provides continuity for a Technology Transfer Program in the areas of finance, management, documentation and marketing;

(3) continuing industrial involvement is one major evidence of the success and value of a Technology Transfer Program.

The renewal campaign led to seven of the first-year members renewing for a third year of participation. Concurrent with the renewal activity was the upgrading of a number of the membership fees to higher dollar volumes. In some instances,where fees were not increased, negotiations between the Center and the industrial organization let to a reduction in the volume of that company's activity.

The increase in company participation was accomplished despite the fact that twenty of the forty-two companies added since the initial eleven, did not continue their memberships beyond their first year.

This loss of twenty company memberships is believed to be caused by one or more of a number of factors, as follows:

(1) Lack of sufficient literature in the NASA files that was pertinent to limited interests of some companies.

(2) Insufficient time spent by company staff on review of information provided.

(3) Insufficient use of other than NASA literature to service company needs.

(4) Change in company staff serving as liaison with KASC.

(5) Insufficient contact with member companies by engineering consultants.

(6) Occasional delays in providing document reproduction service.

Steps are being taken to relieve this situation as follows:

(1) Initial contacts with potential members are made with increasing care;

(a) to avoid "overselling" in terms of file content
(b) to emphasize the importance of careful review of materials sent in order to obtain maximum benefit from the service

(2) Continuing contacts by engineering consultants are being scheduled on a more frequent basis;

(a) To assure greater interaction with staff of member companies
(b) To attempt to overcome difficulties ensuing from changes in liaison staff of member companies

(3) The Engineering consultants group has been augmented by two doctoral students.

With regard to service delays in provision of documents, it is anticipated that the initiation of "hard copy" service directly from the KASC during the fourth year will alleviate this problem.

C. Service to Small Businesses

The year 1966-1967 saw the establishment of a new cooperative venture between the National Aeronautics and Space Administration and the Small Business Administration. This cooperation let to the selecting and servicing, on a free, one-year trial basis of six SBA companies. The purpose of this experiment was to determine the optimum methods and possible results of applying a controlled information dissemination program for small businesses with a high potential for Technology Transfer. The organizations serviced by the KAS Center' were: Astro Metallurgical, Crobaugh Laboratories, Gilmore Industries, Horizons Incorporated, Rand Development Corporation and Reuter-Stokes. At the conclusion of the year of free service, all six SBA organizations were solicited to join the program on a fee-paying basis.

Three of the organizations, Astro Metallurgical, Gilmore Industries and the Rand Development Corporation have declined the offer to extend their membership in the Technology Transfer Program through a fee-paying membership and the other three organizations have yet to be heard from.

While it is somewhat difficult to ascertain any meaningful trends from the sampling of the three organizations, it is at least interesting to note that two of the companies, Astro Metallurgical and Gilmore Industries, both indicated that their inability to utilize the service to its utmost caused them to decline. This inability seems to be based upon the companies' belief that successful application to the program is directly dependent upon a sophisticated review and evaluation of the information which is disseminated.

The situation relevant to the Rand Development Corporation is somewhat different. At the present time, Rand is apparently undergoing federal investigation regarding one of its products. Rand has requested an extension of time in order to decide whether or not to join the dissemination activity on fee-paying basis, ostensibly in the hope that the investigation will be concluded and the company will return to normal. In none of these three SBA evaluations was either the content of the information file or the lack of quality of service cited as a major contributing factor.

Copies of the letters from Astro Metallurgical, Gilmore Industries and the Rand Development Corporation appear in Appendix 2, along with a summary of services provided during the year to all six companies.

D. Trade Press Service

A second new area of Technology Transfer service was initiated by the KAS Center by providing retrospective and/or current awareness literature searches through the existing NASA information file for selected trade press publications.

To date, twenty-eight unique questions have been processed. These include one for Product Engineering Magazine, nine for Steel Magazine, four for Package Engineering Magazine, and fourteen for Materials in Design Engineering. Nineteen retrospective searches have been conducted for the four magazines being served, and fourteen continuing current awareness questions are being processed each month. One retrospective search has been conducted for Product Engineering Magazine, four for Steel Magazine, four for Package Engineering, and ten for Materials in Design Engineering Magazine. One current awareness question is pending for Product Engineering Magazine, five for Steel Magazine, four for Package Engineering Magazine, and four for Materials in Design Engineering.

Results of the Steel Magazine searches are being sent through Mr. Jim Mahoney of NASA, to Mr. Robert F. Huber, Executive Editor. Results for Materials in Design Engineering Magazine are being submitted through Mr. George Howick, NASA, in the following manner: all retrospective searches to Mr. Michael Busche, Associate Editor; two current awareness questions to Mr. Jack Hauck; two current awareness questions to Mr. John Mock. Results of the Package Engineering Magazine searches are being sent through Mr. George Howick, NASA, to Mr. Charles Goerth, Associate Editor. Results of the Product Engineering searches are being sent through Mr. George Howick, NASA, to Mr. John Kevern, Associate Editor.

The method of operation is as follows: a request for a search, along with a statement defining the question and the scope of coverage to be given that question, is provided by NASA TU Headquarters to the KAS Center. The question is then analyzed by the appropriate subject specialist, a strategy is developed, and the search is conducted. Results of the search are evaluated by the same subject specialist, and those materials meeting the criteria of the search question are transmitted to the magazine. At no time during the operation of the program has more than seventy-two hours elapsed between the time of receiving the question in the KAS Center and placing results in the mail.

In connection with the trade press experiment, negotiations were initiated between the KAS Center and Materials in Design Engineering Magazine for the provision of packaged literature searches for the magazine's readers. In an attempt to evaluate the potential applicability of the NASA file to Materials in Design Engineering readers, an investigation of reader interests in terms of NASA coverage was conducted by the Center. This led to an evaluation of literature coverage based not only upon the volume of citations but also upon a subjective evaluation of strengths and weaknesses of the various NASA categories. The results of this evaluation appears as Appendix 3.

E. Cooperative Activities

The KAS Center has been especially active during its third year of operation in continuing and expanding the cooperative relationships which it has developed among the many RDC's. Considerable aid was provided to the University of Southern California and to the University of Connecticut through discussions of the problems, solutions and requirements of developing and maintaining a Technology Transfer program. Computer hardware and software systems, reporting, records keeping and management techniques were discussed, and forms, computer programs and other support materials were provided.

Additionally, meetings were held with representatives of Midwest Research Institute, and of North Carolina Science and Technology to investigate the mutual problem of the ramifications of IBM System/360 on the operations of a Regional Dissemination Center, and to evaluate alternative plans of action.

F. RDC Meeting

The KAS Center was host to a meeting of Regional Dissemination Centers representatives and NASA TUD Headquarters personnel on May 19, 20 and 21, 1966, at the Flying Carpet Motel in Pittsburgh. Among the topics covered were computer programming, systems design, cost accounting, the State Technical Services Act, NASA future plans, and the various RDC's marketing activities. The marketing discussion by Mr. Minor Hawk of the KAS Center led to a request that Mr. Hawk conduct a special one-day seminar on marketing activities. To this end, a "Minor Hawk Seminar" was held at the Hotel Webster Hall in Pittsburgh on June 9, 1966. Marketing representatives from the various regional dissemination centers were in attendance, and were instructed in the do's and don't's of technology transfer marketing.

G. Retrospective Searches

For the past two years, special retrospective searches have been performed at the request of NASA information analysts and technical consultants. During the third year of operation, activity in demand, retrospective literature searching was greatly increased. In addition to handling direct requests from Technology Utilization Division Headquarters personnel, materials were also provided to Battelle Memorial Institute, IITRI, and Southwest Research Institute.

The function of the KAS activity in conjunction with the various research institutes is to provide comprehensive literature coverage in support of existing NASA programs, especially as support for the preparation of TU Bibliographies and state-of-the-art reports. As a direct result of these special literature searches, both Southwest Research and Battelle Memorial Institutes have been converted into fee-paying Pitt-NASA Technology Transfer members. Of special interest is the cooperative venture which has been established between the KAS Center and Southwest Research Institute in the area of biomedical applications of aerospace technology, and which reflects NASA's increased dedication to the entire health sciences area.

H. New Computer Programs

Concurrent with the expansion of companies, dollar volumes and programs has been a dramatic rise in the numbers of document requests and abstracts being both retrieved and disseminated. (See Appendix 4). Because of these increased demands made upon the existing system, a reevaluation of the computerized information handling mechanisms at the KAS Center was instituted. This investigation led to the development of a computer software processing system to handle both current awareness and retrospective searching. Significant reductions in computer time, up to 90% in some cases, have been effected. The software, which is currently being applied to the IBM 7090 computer, is adaptable to many different computer systems, and has already evoked interest on the part of at least one additional RDC. Computer program listings appear in Appendix 5.

While the revamping of the computerized production system was of critical importance to the economical operation of the KAS Center, a number of additional basic and applied research programs were also implemented during the third year of the Technology Transfer Program at the University of Pittsburgh. The thesaural development program which is designed to create a working vocabulary of aerospace terminology with dependent business terms and cross-references, has been computerized. Automatic monthly increments of the thesaurally-related information are being processed and evaluated.

I. Management Information Systems

Two computerized management information systems were completed during the year 1966-1967. Both of them have as their purpose to make operational the objective of "management by exception" by providing accurate information on the status of all Technology Transfer functions in a rapid manner. The first of these involved the design and implementation of a program representing various functions involved in the operations of a regional dissemination center. The program takes into consideration the operating variables, and attempts to predict the requirements for the successful maintenance of a Technology Transfer system based upon any volume of profiles and/or clients served. Sample output from the computer model of an RDC is included in Appendix 6.

The second management information system involves the collecting and reporting of the status of all participating companies, contracts, technical analysts and questions for a given period of time. This system has the ability to highlight discrepancies and deviations from a predicted norm, and to cause management decisions to be effected as required. Together, the two management information systems provide an evaluation of where the KAS Center has been, where it is currently, and where it may expect to be in the future.

J. Other Computer Programming Effort

In conjunction with future expectations, members of the KAS staff have been evaluating the potentials and problems of converting their operating search systems from IBM 7090 to IBM System/360 processing. The possibility of remote console, on-line/real-time searching is also being evaluated.

K. Transfers

The School of Engineering of the University of Pittsburgh, while functioning as an integral portion of the Technology Transfer Program for the past two years, has become increasingly involved in the total activity of Technology Transfer. As companies have sustained their membership in the KAS project over a period of years, their trust in, and reliance upon the engineering consultants has grown. Consequently, increasingly heavy workloads and demands are placed upon the consulting staff as they attempt to service both the renewing participants and the new acquisitions as well. In addition to the responsibilities of defining and clarifying search questions, and evaluating and interpreting search results, the engineering consultants have also been charged with the responsibility of uncovering areas of documentable Technology Transfer within the companies they serve. As a direct result of this documentation activity, the KAS Center has been able to report a series of well defined transfers during its third year of operation. Two of these transfers were of sufficient value to justify authorization by Technology Utilization Headquarters for producing a film about their evolution and development. One of these transfers came from Norbatrol Electronics Corporation, and led to the development of a fluidized coating for heat dissipation which has resulted in a patent application. This innovation, a direct result of the Technology Transfer Program at the University of Pittsburgh, has resulted in the miniaturization of heat dissipating equipment. (See Appendix 7.)

The second outstanding documented Technology Transfer came from Semi-Elements, Incorporated, of Saxonburg, Pennsylvania. Information supplied by specific NASA documents, especially N64-13720 and N64-16326, permitted Semi-Elements to build new types of furnaces for the creation of specific single crystals. These furnaces have provided Semi-Elements with the capability of expanding their products to cover areas which they had been unable to approach previously. In addition, the French Atomic Energy Commission has requested Semi-Elements, as a direct result of the company's new capabilities, to build a series of single crystal furnaces for the production of ruby laser crystals. (See Appendix 8). Other transfers have been reported during the year, representing both large and small corporations, and are detailed in Appendix 9.

L. Other NASA-related Activities

As further evidence of the increased engineering participation in the Technology Transfer Program, Dr. L. Albert Scipio, Jr. an engineering consultant and Professor of Mechanical Engineering at the University has received a separate NASA contract to develop a state-of-the-art report on structural materials and designs.

M. Personnel

Change in personnel occurs from time to time. During the third year of operation, the KAS activity lost its Director of Marketing, Mr. Minor Hawk, to the Graduate School of Engineering. The transition from Mr. Hawk to the KAS Center's new Marketing Director, Mr. Edmond Howie, was accomplished in a matter of two weeks, without any break in the continuity of service.

N. Other KAS Programs

During the three years of operation as a Regional Dissemination Center for the National Aeronautics and Space Administration, the KAS Center has undertaken a number of other programs in the information sciences field. These have involved relevancy studies (sponsored by the National Institutes of Health), Information Systems evaluation (sponsored by DIA), and Man-Machine interaction Studies (sponsored by ONR). A summary of some of the more significant programs is given in Appendix 10.

APPENDIX 1

NASA-PITT-INDUSTRY COMPANY PARTICIPANTS LISTING

COMPANY PARTICIPANTS IN THE NASA-PITT-INDUSTRY SPACE AND TECHNOLOGY TRANSFER PROGRAM

Alco Products, Incorporated

Aluminum Company of America

American Machine and Foundry Company

American Shear Knife Company

AMP, Incorporated

Astro-Metallurgical Corporation

Atomatic Manufacturing Company

Battelle Memorial Institute

Bendix Corporation

Berry Metal Company

Bio-Dynamics, Incorporated

Black and Decker Manufacturing Company

Boeing Company

Burndy Corporation

Carmet Company

Copperweld Steel Company

Crobaugh Laboratories, Incorporated

Elliott Company (Division of Carrier Corporation)

Firth Sterling, Incorporated

General Electric Company

Gulf Research and Development Corporation

Horizons, Incorporated

Instrumentation Laboratory, Incorporated

International Resistance Company

Johns-Manville

Johnson and Johnson

Jones and Laughlin Steel Corporation

Kawecki Chemical Company

Kennametal, Incorporated

Koppers Company, Incorporated

Latrobe Steel Company

The Lord Corporation (2 Divisions)

Lunn Laminates, Incorporated

McConway and Torley Corporation

McCreary Tire and Rubber Company

Mobay Chemical Company

Newcomer Products, Incorporated

Norbatrol Electronics Corporation

Ohio Crankshaft Company

Pesco Corporation (Division of Borg Warner)

Pittsburgh Materials and Chemicals Corporation

Pittsburgh Plate Glass Company

Reactive Metals, Incorporated

Reuter-Stokes, Incorporated

Robertshaw Controls Company

H. H. Robertson Company

Rockwell Manufacturing Company

Royston Laboratories, Incorporated

Schroeder Brothers Corporation

Semi-Elements, Incorporated

Simmonds Precision

Snap-Tite Incorporated

Southwest Research Institute

Stackpole Carbon Company

Sylvania Electric Products, Incorporated

Technicon Instruments Corporation

Time, Incorporated

United States Bureau of Mines

United States Steel Corporation (2 Divisions)

Univac (Division of Sperry Rand)

Universal Cyclops Specialty Steel Division

Vanadium-Alloys Steel Company

Westinghouse Electric Corporation

Edwin L. Weigand Company

APPENDIX 2

PITT-NASA-SBA VOLUME OF SERVICE REPORT
And
LETTERS FROM THREE COMPANIES

UNIVERSITY OF PITTSBURGH-NASA-SMALL BUSINESS ADMINISTRATION SERVICE REPORT

COMPANY	QUESTIONS	ABSTRACTS RETRIEVED	ABSTRACTS SENT	ABSTRACTS PERTINENT	DOCUMENTS REQUESTED
Astro-Metallurgical Corporation	4	590	84	37	9
Crobaugh Laboratories, Incorporated	6	3510	1550	1374	120
Gilmore Industries, Incorporated	3	327	140	21	18
Horizons, Incorporated	7	3170	1331	798	633
Rand Development Corporation	6	1447	440	226	114
Reuter-Stokes, Incorporated	3	791	401	168	21

MAR 13 1967

17.

GILMORE INDUSTRIES·INC.

instrumentation systems for industry and aerospace

3355 Richmond Rd., Cleveland, Ohio 44122, Tel. 216-464-1200

March 9, 1967

Knowledge Availability Systems Center
University of Pittsburgh
Pittsburgh, Pa. 15213

Attention: Mr. Edmond Howie
Engineering Coordinator

Dear Mr. Howie:

We have enjoyed our relationship with the staff at the Knowledge Availability Center and wish to thank you and the staff for the splendid cooperation and courtesies extended to Gilmore Industries.

After careful consideration, we have determined that Gilmore is not able to make full use of the service, and for this reason we would like to withdraw from the program. We feel that this action will make the service available to some other organization better able to utilize your excellent facility.

Very truly yours,

GILMORE INDUSTRIES, INC.

J. N. Crum

J. N. Crum
Chief Engineer

JNC/nlb
cc: Mr. James E. Shondel

Copy to:

Sales Offices in Principal Cities

CABLE ADDRESS
RANDEV-CLEVELAND

TELEPHONE
216—851-6300

MAR 3 1967

18.

RAND

DEVELOPMENT CORPORATION

13600 DEISE AVENUE CLEVELAND, OHIO 44110

March 2, 1967

Mr. Edmond Howie
Engineering Coordinator
The Knowledge Availability Systems Center
University of Pittsburgh
Pittsburgh, Pennsylvania 15213

Dear Mr. Howie:

We refer to your letter of 23 February 1967 concerning the approaching termination of our participation in your NASA Technology Transfer Program. Our experience with the resulting information attained through your program has been estimated to be most effective. The results of the accrued literature cannot be specifically estimated in terms of dollars and cents, but we do consider that its value was presumably extensive.

We are interested in the potential of a continuing program. However, current circumstances preclude our immediate participation in such an activity. Therefore, may we request the privilege of holding our decision in abeyance until present conditions stabilize. We will retain fee schedule information that you submitted and hope that we may have the prospect of discussing active participation in your Technology Utilization Program at a later date.

We wish to extend our thanks and appreciation of efforts to yourself, Dr. Holzman, Mr. McGee, and all of the profile monitors who so effectively created the searches. I do hope to have the pleasure of meeting all of you again in the not so distant future.

Thank you.

Very truly yours,

RAND DEVELOPMENT CORPORATION

E. Hart Green

E. Hart Green
Assistant Director of Laboratories

EHG/cl

APR 19 1967

19.

ASTRO METALLURGICAL

3225 LINCOLN WAY, WEST
P.O. BOX 516
WOOSTER, OHIO 44691

. . . SPECIALISTS IN TITANIUM • TANTALUM • ZIRCONIUM • COLUMBIUM

Phone: 263-3075 – Area Code 216
TELEX 98-725

April 17, 1967

Knowledge Availability Systems Center
University of Pittsburgh
Pittsburgh, Pennsylvania 15213

Attention: Mr. Edmond Howey, Engineering Coordinator

Dear Mr. Howey:

I have your letter of February 23, 1967, which I must confess became misplaced. We have certainly appreciated the trial offer to evaluate this system and were quite pleased at being selected by Jim Shondel to participate in it.

I talked to Jim several times over the past months and must confess we have not been really gaining a great deal from the service. I don't think this is necessarily the part of the information supplied but probably is one of several situations facing our business at this time.

We are in a rapidly growing era and have had very little time to analyze the information supplied and apply it to practical use. I think we are probably too small of a company or have too small of a staff to assign a technician to review the data, run necessary tests, and apply it to our products.

In view of this, I don't think it would be advisable for us to subscribe to the service until our own operations become a little more sophisticated and we are able to make good use of the data. Thanks again for the past year's service.

Very truly yours,

ASTRO METALLURGICAL

C. Stitzlein

Conard F. Stitzlein
Vice President & General Manager

CFSnr
c.c. Jim Shondel

Copy to:

Div. of Waukesha Industries Corp.

APPENDIX 3

EVALUATION OF NASA COVERAGE OF INTEREST AREAS FOR MATERIALS IN DESIGN ENGINEERING

KNOWLEDGE AVAILABILITY SYSTEMS CENTER - NATIONAL AERONAUTICS AND SPACE ADMINISTRATION EVALUATION OF LITERATURE COVERAGE FOR MATERIALS IN DESIGN ENGINEERING

MASTER CLASSIFICATION OF MATERIALS, FORMS, FINISHES

(0-10 RATING SYSTEM BY ASCENDING IMPORTANCE)

1. METALS

A. Irons and Steels
- a. Irons(cast)--gray, nodular, malleable (1)
- b. Carbon Steels(wrought and cast)--incl. Wrought and Ingot Iron (1)
- c. Low Alloy Steels (wrought and cast) (1)
- d. Corrosion and Heat Resisting Steels (except superalloys) (6)
- e. Tool Steels (1)
- f. Specialty Steels (7)
- g. Irons and Steels (n.e.c.) (5)

B. Nonferrous Metals and Alloys
- a. Aluminum (10)
- b. Copper (4)
- c. Magnesium (4)
- d. Nickel (6)
- e. Titanium (10)
- f. Zinc (3)
- g. Precious Metals--Gold (1), Silver (3), Platinum (1)
- h. Superalloys--incl. iron-base superalloys (10)
- 1. Nonferrous Metals (n.e.c.) (8)

C. Metal Composites
- a. Clad and Laminated Metals--incl. Sandwich Materials (7)
- b. Precoated Metals (2)
- c. Metal Composites (7)

2. NONMETALLICS

A. Plastics
- a. Thermoplastics
  - (1) Cellulosics (1)
  - (2) Polyvinyls and vinyls (8)
  - (3) Polystyrenes and styrenes (3)
  - (4) Acrylics (2)
  - (5) Polyamides (2)
  - (6) Polyethylenes (3)
  - (7) Fluorocarbons (6)
  - (8) Polypropylene (1)
  - (9) Acetal (1)
  - (0) Polycarbonates (1)

- b. Thermosets
  - (1) Phenolics (3)
  - (2) Ureas (1)
  - (3) Melamines (0)
  - (4) Polyesters (8)
  - (5) Diallyl phthalate (Allylic) (1)
  - (6) Epoxies (7)
  - (7) Silicones (2)
  - (8) Urethanes (7)

c. Plastics (n.e.c.) (9)

B. Nonmetallics (other than plastics)
   a. Ceramics, Glass, Refractories
      (1) Ceramics (8)
      (2) Glass (10)
      (3) Refractory Compounds (10)

   b. Carbon and Graphite (5)

   c. Rubber
      (1) Natural (2)
      (2) GR-S (0)
      (3) Nitrile (1)
      (4) Butyl (2)
      (5) Neoprene (1)
      (6) Polysulfide (2)
      (7) Silicones (3)
      (8) Fluorinated (3)
      (9) Urethanes (4)

   d. Paper and Wood Base Materials (1)

   e. Fibers (10), Textiles (1), Felts (1)

   f. Nonmetallics (other than plastics) (n.e.c.) (8)

C. Nonmetallic Composites

   a. Plastics Laminates--Low and High Pressure (5)

   b. Reinforced Plastics (other than laminates) (8)

   c. Sandwich Materials (4)

   d. Nonmetallic Composites (n.e.c.) (7)

3. <u>METAL-NONMETALLIC COMPOSITES</u>

A. Laminates and Sandwich Materials (3)

B. Prefinished and Clad Materials (3)

C. Metal-Nonmetallic Composites (n.e.c.)-incl. Cermets,etc. (7)

4. <u>MATERIAL FORMS</u>

A. Metal Forms

   a. Mill Products (basic forms) (1)
   b. Castings (2)
   c. Forgings (4)
   d. Formed Metal Parts (6)
   e. Extruded Sections (6)
   f. Tubing and Pipe (5)
   g. Metal Powder Parts (1)
   h. Machined Parts (5)
   l. Joined Parts (4)
   j. Processed Plate, Sheet, Strip (2)
   k. Metal Forms (n.e.c.) (3)

B. Nonmetallic Forms

a. Moldings (2)
b. Sheet Forms (1)
c. Rod, Tubing, Extrusions (4)
d. Films and Tapes (10)
e. Castings (3)
f. Foams (5)
g. Nonmetallic Forms (n.e.c.) (4)

5. SURFACE COATINGS AND TREATMENTS

A. Metal Coatings

a. Plated Metal (6)
b. Sprayed and Deposited (6)
c. Metal Coatings (n.e.c.) (10)

B. Organic Coatings

a. Plastics (4)
b. Elastomers (3)
c. Strippable (1)
d. Organic Coatings (n.e.c.) (7)

C. Ceramic and Vitreous Coatings

a. Porcelain and Glass (1)
b. Ceramic Coatings (2)
c. Ceramic and Vitreous Coatings (n.e.c.) (2)

D. Chemical Conversion Coatings

a. Phosphate (3)
b. Anodized (2)
c. Chromate (1)
d. Chemical Conversion Coatings (n.e.c.) (2)

E. Diffusion Treatments

a. Carburizing (1), Nitriding (1), Cyaniding (1)
b. Chromizing(1), Calorizing (0), Sheradizing (0), Siliconizing (1)
c. Diffusion Treatments (n.e.c.) (1)

F. Impregnants (2)

G. Mechanical Finishes

a. Tumbled (1)
b. Polished, Buffed, Burnished, Brushed (2)
c. Blasted, Peened (1)
d. Mechanical Finished (n.e.c.) (2)

6. METHODS

A. Joining

a. Welding (10)
b. Brazing and Soldering (4)
c. Adhesive Bonding (8)
d. Mechanical Fastening and Fasteners (3)
e. Joining (n.e.c.) (10)

B. Heat Treatment

a. Hardening (through and surface) (5)
b. Annealing, Normalizing, Stress Relief (6)
c. Heat Treatment (n.e.c.) (5)

C. Testing and Inspection

a. Mechanical (4)
b. Physical (10)
c. Nondestructive (10)
d. Testing and Inspection (n.e.c.) (10)

D. Methods (n.e.c.) (9)

7. APPLICATIONS OF MATERIALS--BY INDUSTRY AND PRODUCT

A. Machinery (except electrical)

a. Agricultural Machinery and Tractors (0)
b. Metalworking Machinery, Construction and Mining Machinery (4)
c. Office and Store Machinery and Devices (0)
d. Service Industry and Household Machines (0)
e. Special Industry Machinery (10)
f. Machinery (n.e.c.) (3)

B. Electrical Machinery, Equipment and Supplies

a. Electrical Generating, Transmission, etc. (8)
b. Electrical Appliances (0)
c. Communication Equipment (radio,TV,electronics) (10)
d. Electrical Machinery (n.e.c.) (6)

C. Transportation Equipment

a. Motor Vehicles and Parts (1)
b. Aircraft and Parts (9)
c. Ships, Boats and Parts (4)
d. Railroad Equipment and Parts (1)
e. Transportation Equipment (n.e.c.) (2)

D. Furniture and Fixtures (0)

E. Professional, Scientific and Controlling Instruments,Photographic,etc. (9)

F. Primary Metal Industries (and Nonmetal Mining) (3)

G. Fabricated Metal Products (2)

H. Heating Apparatus (except Electrical) and Plumbers' Supplies (1)

I. Ordnance (0)

J. Chemical and Process Industries (8)

K. Miscellaneous Manufacturing (n.e.c.) (6)

8. APPLICATIONS OF MATERIALS--BY PRODUCT COMPONENTS

A. Mechanical Components: Gears (4), Cams (1), Brakes (2), Clutches (1), Bearings (10), Plates (1), Shafts (2), Linkages (2)

B. Structural Components: Frames (2), Housings (1), Enclosures (1)

C. Electrical Components: Motor Parts (2), Switch Parts (1)

D. Hydraulic Components: Cylinders (5), Pistons (2), Gaskets (1), Packings (1), Sealing (2)

E. Components (n.e.c.) (4)

9. SERVICE PROPERTIES OF MATERIALS

A. Structural or Mechanical

a. Static Conditions--Strength, Stiffness, etc. (10)
b. Dynamic Conditions--Fatigue, Impact, etc. (10)

B. Weight (10), Density (8), Volume (4)

C. Corrosion and Environmental Exposure

a. Chemical (8)
b. Water (6)
c. Weather (5)

D. High Temperature

a. Strength (10)
b. Stability (9)
c. Expansion and Distortion (3)

E. Surface Deterioration or Wear (except corrosion)

a. Abrasion (2)
b. Friction (7)
c. Bearing (8)

F. Electrical and Magnetic (8)

G. Insulation (not electrical)

a. Heat and Cold (8)
b. Sound (7)
c. Vibration (8)

H. Nuclear (9)

I. Appearance (2)

J. Processing Characteristics

a. Weldability and Joinability (10)
b. Formability (7)
c. Machinability (6)
d. Finishability (4)

10. ECONOMICS OF MATERIALS

A. Supply and Availability (1)

B. Prices or Cost (0)

11. MATERIALS ENGINEERING

A. Designing with Materials (3)

B. Selection and Evaluation of Materials (8)

APPENDIX 4

ANNUAL SUMMARY OF SEARCH RESULTS

SUMMARY OF SEARCH RESULTS
March 1, 1966 to February 28, 1967

	Current Awareness	Retrospective	Sample	Total
Companies Served	81	66	162	246
Searches Performed	12,144	637	162	12,943
Citations Retrieved				
Aerospace Literature:				
Abstracts	184,201	58,207	8,819	251,227
(mechanically)	(174,482)	(10,747)	(0)	(185,229)
(manually)	(9,719)	(47,460)	(8,819)	(65,998)
Tech Briefs	264	10	428	702
Other Literature:				
Abstracts	984	362	0	1,346
Citations Forwarded				
Aerospace Literature:				
Abstracts	60,399	28,427	7,292	96,118
(mechanically)	(53,366)	(2,758)	(0)	(56,124)
(manually)	(7,033)	(25,669)	(7,292)	(39,994)
Tech Briefs	239	10	373	622
Other Literature:				
Abstracts	529	332	0	861
Citations Evaluated				
Aerospace Literature:				
Abstracts	42,268	21,415	-	63,683
(related)	(28,948)	(12,935)	-	(41,883)
(not related but of interest)	(4,222)	(2,743)	-	(6,965)
(not related and of no interest)	(9,098)	(5,737)	-	(14,835)
Tech Briefs	85	32	-	117
(related)	(55)	(17)	-	(72)
(not related but of interest)	(17)	(1)	-	(18)
(not related and of no interest)	(13)	(14)	-	(27)
Other Literature:				
Abstracts	166	118	-	284
(related)	(105)	(113)	-	(218)
(not related but of interest)	(34)	(2)	-	(36)
(not related and of no interest)	(27)	(3)	-	(30)
Documents Requested				
Aerospace Literature:	8,076	2,743	-	10,819
(known to result from searches)	(6,903)	(2,743)	-	(9,646)
(not known to result from searches)	(1,173)	(0)	-	(1,173)

APPENDIX 5

COMPUTER PROGRAM LISTING FOR PITT-SEARCH

FOR IBM 7090

One of the main costs involved in RDC activity were those relative to the processing of the NASA computer tapes for the conducting of current awareness and retrospective literature searches. In order to decrease these costs, and to help realize the goal of self-support, a detailed evaluation of the Pitt search and retrieval mechanisms, and of other available computer searching techniques, was conducted. At the close of this investigation, the KAS Center director decided to invest in a complete reprogramming effort for processing all of the computer-based elements of the NASA search system.

The first program which was converted to the new searching system was that of reformating. It had long ago been decided that the KAS activity would utilize effectively only certain portions of the NASA master tape as supplied by Documentation Incorporated, and would physically, through a computer program, strip off the information which was extraneous to the Pitt operation. The following listing, entitled "File Manipulation Subroutine" indicates, in the Fortran language, the actual instructions used to accomplish this reformating job. From the basic tape, the reformating program removes the document accession number, the published category number, the issue number and the index entries, and writes these four categories on a new tape. Concurrent with the reformating, messages are printed out for KAS use indicating which documents have been "killed" and which documents exceed certain predetermined specifications such as length and/or number of index entries.

The newly prepared and KAS-formatted NASA tape then serves as input to the searching routines. In the past, each individual expression which was to be searched had to be explicitly stated. Consequently, if one wished to look for high strength or nickel steel, he would have to write a strategy of "high strength * steel & nickel * steel". In the new system, parenthetical expressions replace explicit statements, so that the preceeding example is now worded "steel * (high strength & nickel)".

Another change which the new search subroutine brings to the Pitt-NASA program is the ability to simultaneously process 1,200 active programs during one pass of the reformatted tape. This is a considerable improvement over the old search system which permitted only 100 questions to be processed during a tape pass. A portion of the search subroutine, entitled "KAS phase 2-3 load/score" appears in this Appendix.

Another change instituted is that of compiling questions for the KAS searches. In the past, each question which was processed by the search system was treated as an individual entity, without any attempt to correlate the similarities between strategies and search terms. Consequently, the word "steel" might be searched ten or fifteen times per document during a given pass of the computer tape. With the new search scheme, all questions are put through a compiler which analyzes the questions for terminology, length (both in the number of terms, and in the number of characters per term), punctuation, and duplication of identical search terms within the same body of questions. By checking for and indicating duplication, i.e., the same term being used in two or more questions, and keeping internal records of these duplicated terms, the computer is required to search for a given term only once per document, regardless of how many times that term may be used as a search query. At the close of the question compilation phase, the computer has a structured list in memory of all search terms being utilized for this particular run, along with question tag indicators relating the individual or several terms to the appropriate strategy(s).

Consequently, after moving from the question compiler to the actual search phase, when the computer locates a "hit" or match between a documentindex entry and an input search query, it then scores that hit not only for the first question using that term, but automatically for all queries using that term. Proving of the individual strategies occurs during tape reading time of the next document. A portion of the listing for the question compiler also appears in this Appendix.

By integrating the reformating, question compilation and search techniques into a unified computer system, the KAS Center has been able to effect a significant reduction in the number of hours being consumed for computerized searching of the NASA tapes. Detailed operating instructions follow immediately after the program listings.

```
$PUNCH OBJECT
$COMPILE FORTRAN
```



```
      SUBROUTINE MFL(MOD ,NFILE,NREC,LOC,LOCB)
      DIMENSION LOC(320),LOCB(320),LBUX(320)
      DIMENSION IXA(6)
      DIMENSION LX(150)
      COMMON LX, IFRE, JFRE,ISMX
      COMMON LSC
      EQUIVALENCE (IXA(1),IX1),(IXA(2),IX2),(IXA(3),IX3),(IXA(4),IX4),
     1  (IXA(5),IX5),(IXA(6),IX6)
C       VALUE OF FUNCTION IS NUMBER OF RECORDS IN CURRENT BLOCK
C       COMMON VAR MFLX HAS NUMBER OF THIS REC WITHIN CURRENT BLOCK
C       ON OPEN IF LOCB .G. 0 IT IS THE EXPECTED NUMBER OF RECORDS
C         TO BE WRITTEN ON THIS FILE.  SPACE WILL BE ASSIGNED FOR IT.
C         MFL=-1 IF SPACE NCT AVB.
C       ON CLOSE THE SPACE WILL BE RETURNED IF MODE (-9-NUMREC
C
C       MODE VALUES -9 CLOSE, -1 OPEN, 2 GET, 3 PUT, 0 PUT IMMEDIATE
C       MODE 4 IS PUT WITH NO READ OF NEXT SECTOR
C     ON OPEN BUFFER SIZE FROM NREC
C     RECORD SIZE FROM LOC IF NONZERO
C     ON CLOSE ONLY FILE NUMBER AND BUFFER LOC ARE USED
C     MEANINGS IN LX
C     NWPR,NRPB,NBPS,NFPR/NWFL,NCRB,NEMPT
C
      IFL=2
    1 NFL=NFILE
      MODE=MOD
      N320=LSC
      N321=N320+1
      J=(NFL-1)*6
      DO 5 NR=1,6
    5 IXA(NR)=J+NR
   10 IF(MODE+1)200,100,200
C     OPEN
  100 LX(IX5)=-1
      LX(IX4)=IABS(LX(IX4))
      NRC=LOC(1)
      IF(NRC)115,115,110
  115 NRC=LX(IX1)
  110 LX(IX1)=NRC
      NR=NREC
       IF(NR-LSC)117,117,116
  116 NR=LSC
  117 NRPB=NR  /NRC
      LX(IX2)=NRPB
      NR=LSC/NRC
      NBPS=(NR+NRPB-1)/NRPB
  125 LX(IX3)=NBPS
      IF(LOCB(1))136,136,130
```

```
C       ASSIGN SPACE
  130 IS=(LCCB(1)+NR-1)/NR
      IF(JFRE+IS-ISMX)131,131,134
C       IS AVAILABLE
  131 LX(IX4)=JFRE
      JFRE=JFRE+IS
  136 IS=1
  132 RETURN
C       SPACE NOT AVAILABLE
  134 IS=-1
      GO TC 132
C     MODE-9    CLOSE,0 PUT+WRITE,2 GET
C     3 PUT
  200 NWPR=LX(IX1)
      NRPB=LX(IX2)
      NBPS=LX(IX3)
      NWFL=LX(IX4)
      NCRB=LX(IX5)
      NFPR=IABS(NWFL)
C     ACCOUNT FOR POSSIBLE EMPTY FRONT OF SECTOR
      NRC=NREC-1+LX(IX6)
      NRPS=N320/NWPR
      IS=NRC/NRPS
      IND=NRPB-NRPS
      ISR=NRC-IS*NRPS
      IB=ISR/NRPB
      IBB=IB+IS *NBPS
      ISR=ISR-IB*NRPB
      IRX=ISR*NWPR+1
      IXMT=NWPR*NRPB
      IBX=IB*IXMT+1
      IS=IS+NFPR
C
      IF(MODE)290,300,210
  210 IF(IBB-NCRB)215,230,215
  215 IF(NWFL)310,220,220
C     RETURN HERE AFTER WRITING
  220 IF(MODE-4)221,228,221
C       IF MODE .E. 4, DO NOT READ
  221 IF(IND)222,226,222
  222 CALL READ(IFL, IS,LBUX)
      DO 224 J=1,IXMT
      LOCB(J)=LBUX(IBX)
  224 IBX=IBX+1
      GO TO 228
  226 CALL READ(IFL ,IS,LOCB)
  228 LX(IX5)=IBB
  230 IF(MODE-2)235,250,235
  235 DO 237 J=1,NWPR
      LOCB(IRX)=LOC(J)
  237 IRX=IRX+1
      LX(IX4)= -NFPR
      GO TC 255
  250 DO 252 J=1,NWPR
      LOC(J)=LOCB(IRX)
  252 IRX=IRX+1
C     RETURN NUMBER OF RECORDS IN BLOCK + THIS RNO.
```

```
  255 MFLX=ISR+1                                                     MFL01070
      IS =IMIN(NRPB,NRPS-IB*NRPB)                                    MFL01080
      RETURN                                                         MFL01090
  300 LX(IX5)=-1                                                     MFL01100
      ISP=IS                                                         MFL01110
      ISPX=IBX                                                       MFL01120
      GO TO 315                                                      MFL01130
  310 ISP=NCRB/NBPS                                                  MFL01140
      ISPX=(NCRB-ISP*NBPS)*IXMT+1                                    MFL01150
      ISP=ISP+NFPR                                                   MFL01160
  315 IF(IND)330,320,330                                             MFL01170
  320 CALL WRITE(IFL ,ISP,LOCB)                                      MFL01180
      GO TO 335                                                      MFL01190
  330 CALL READ(IFL ,ISP,LBUX)                                       MFL01200
      K=IXMT                                                         MFL01210
      IF(ISPX+IXMT-N321)362,362,361                                  MFL01220
  361 K=N321-ISPX                                                    MFL01230
  362 CONTINUE                                                       MFL01240
      DO 332 J=1,K                                                   MFL01250
      LBUX(ISPX)=LOCB(J)                                             MFL01260
  332 ISPX=ISPX+1                                                    MFL01270
      CALL WRITE(IFL ,ISP,LBUX)                                      MFL01280
  335 LX(IX4)=NFPR                                                   MFL01290
      IF(MODE)340,350,220                                            MFL01300
  340 LX(IX5)=-1                                                     MFL01310
      IF(MODE+9)341,350,350                                          MFL01320
C       RETURN SPACE                                                 MFL01330
  341 IS=(NRPS-MODE-10)/NRPS                                         MFL01340
      LX(IX2)=-IS                                                    MFL01350
  345 DO 346 I=2,146,6                                               MFL01360
      IF(LX(I))343,346,346                                           MFL01370
C       THERE IS SOME TO RETURN                                      MFL01380
  343 IF(JFRE+LX(I)-LX(I+2))346,344,346                              MFL01390
C       WE CAN RETURN IT                                             MFL01400
  344 JFRE=JFRE+LX(I)                                                MFL01410
      LX(I)=0                                                        MFL01420
      GO TO 345                                                      MFL01430
  346 CONTINUE                                                       MFL01440
  350 RETURN                                                         MFL01450
  290 IF(NWFL)310,335,335                                            MFL01460
      END                                                            MFL01470
```

4536

```
$PUNCH OBJECT                                        33.-1              LDS00010   33-2   302929    05/23/67      11 44 40.7 PM
$ASSEMBLE                                                         LDSKOR 00LDS00020


PAGE 1          KAS PHASE 2-3  LOAD/SCORE                          (MOD 21 OCT 1966) UNIVERSITY OF MICHIGAN 23 MAY 1967
                                                                                           ***BINARY CARD ID LDSKOR00
      ***PROGRAM CARD PREPARED BY UMAP***

     LENGTH 43235        00015 NO. OF SUBS

    ERASABLE 00000        00000 FIRST TVECTOR

      FIRST LOCATION EXECUTED 00223

TRANSFER VECTOR......................NAMES
     00000  622563246267      00    SETDSX                                                                    ID LDSKOR01
     00001  464745436060      00    OPNL
     00002  272563436060      00    GETL
     00003  243123635160      00    DICTR
     00004  243123636260      00    DICTS
     00005  476463436060      00    PUTL
     00006  233063436060      00    CHTL
     00007  234362436060      00    CLSL
     00010  512566436060      00    REWL
     00011  622550472744      00    SEQPGM
     00012  255151465160      00    ERROR
     00013  624751314563      00    SPRINT
     00014  627062632544      00    SYSTEM

PROGRAM LISTING

                           33260        LRQ    EQU    14000         MAX LENGTH RQ LIST                  LDS00050
                           03720        LQUES  EQU    2000          MAX NUMBER OF QUESTIONS             LDS00060
                           43234        QAFIL  EQU    =1                                                LDS00070
                           43233        DFIL   EQU    =2                                                LDS00080
                           01200        QABUFL EQU    640                                               LDS00090
                           02260        DBUFL  EQU    1200                                              LDS00100
                           43234        RQFIL  EQU    =1                                                LDS00110
                           01750        RQBUFL EQU    1000                                              LDS00120

                           00223               START  BLOAD                                             LDS00140

                           00015        BSKOR  EQU    *                                                 LDS00160
     00015  0074 00 4 00000  010               CALL   SETDSX,DICT,SCRMAX                                LDS00170
     00016  3 00000 0 20050  00
     00017  3 00000 0 20051  00
     00020  0074 00 4 00001  010               CALL   OPNL,QAFIL,QATAP,QATAP,QBUF,QABL,=0,=-2,=4        LDS00180
     00021  3 00000 0 43234  010
     00022  3 00000 0 10006  00
     00023  3 00000 0 10006  00
     00024  3 00000 0 04022  010                                                                  ID LDSKOR02
     00025  3 00000 0 04023  010
```

```
      00026  3 00000 0 43232  010
      00027  3 00000 0 43231  010
      00030  3 00000 0 43230  010
      00031  0074 00 4 00001  010         CALL    OPNL,DFIL,DTAP1,DTAP2,DBUF,DBL,DTPLST,=-2,=0          LDS00190
      00032  3 00000 0 43233  010
      00033  3 00000 0 10001  00
      00034  3 00000 0 10002  00
      00035  3 00000 0 02622  010
      00036  3 00000 0 04024  010
      00037  3 00000 0 10047  00
      00040  3 00000 0 43231  010
      00041  3 00000 0 43232  010
      00042  0500 00 0 10007  00          CLA     QMAX                                                  LDS00200
      00043  0767 00 0 00022  00          ALS     18                                                    LDS00210
      00044  0622 00 0 00103  010         STD     SQMAX             SET MAX NUM QUES                    LDS00220
      00045  0441 00 0 00222  010         LDI     DINDIC            INITIALIZE DHITS TO YES             LDS00230

      00046  0074 00 4 00002  010  GDOC   CALL    GETL,DFIL,DOCK                                        LDS00250
      00047  3 00000 0 43233  010
      00050  3 00000 0 00342  010                                                                                 ID LDSKOR03
      00051  0100 00 0 00046  010         TZE     GDOC                                                  LDS00260
      00052  0120 00 0 00056  010         TPL     DOCIN                                                 LDS00270
      00053  0400 00 0 43234  010         ADD     =1                                                    LDS00280
      00054  0100 00 0 00170  010         TZE     ENDDOC            EOF                                 LDS00290
      00055 -0120 00 0 00046  010         TMI     GDOC              TAPE ERROR                          LDS00300

      00056  0054 00  000001  00   DOCIN  RFT     DHITS                                                 LDS00320
      00057  0074 00 4 00003  010         CALL    DICTR             RESET THE DICTIONARY IF LAST DOC HAD HITS  LDS00330
      00060  0057 00  000001  00          RIR     DHITS             SET NO HITS                         LDS00340
      00061 -0500 00 0 00336  010         CAL     DOC-4             GET COUNT OF TERMS                  LDS00350
      00062  0734 00 2 00000  00          PAX     ,2                                                    LDS00360

      00063 -0500 00 2 00336  010  GDADR  CAL     DOCK-4,2          GET TERM                            LDS00380
      00064  0602 00 0 00221  010         SLW     SARG                                                  LDS00390
      00065  0074 00 4 00004  010         CALL    DICTS,SARG        SEARCH DICT                         LDS00400
      00066  3 00000 0 00221  010
      00067 -0120 00 0 00071  010         TMI     *+2               DID NOT HIT                         LDS00410
      00070  0055 00  000001  00          SIR     DHITS                                                 LDS00420
      00071  2 00001 2 00063  010         TIX     GDADR,2,1                                             LDS00430
      00072  0056 00  000001  00          RNT     DHITS                                                 LDS00440
      00073  0020 00 0 00046  010         TRA     GDOC              NO HITS                             LDS00450
      00074 -0500 00 0 00341  010         CAL     DOCK-1            YEAR NUMBER                         LDS00460      ID LDSKOR04
      00075  0602 00 0 00217  010         SLW     QA-1                                                  LDS00470
      00076 -0500 00 0 00337  010         CAL     DOCK-3            DOCUMENT NAME                       LDS00480
      00077  0602 00 0 00216  010         SLW     QA-2                                                  LDS00490
      00100  0774 00 1 00001  00          AXT     1,1                                                   LDS00500
      00101  0020 00 0 00103  010         TRA     *+2                                                   LDS00510

      00102  0774 00 1 00000  00   NXQ    AXT     **,1                                                  LDS00530
      00103  3 00000 1 00046  010  SQMAX  TXH     GDOC,1,**         OUT IF NO MORE QUES                 LDS00540
      00104 -0500 00 1 43226  010         CAL     QUES,1            GET POINTER TO RQ LIST              LDS00550
      00105  1 00001 1 00106  010         TXI     *+1,1,1                                               LDS00560
      00106  0634 00 1 00102  010         SXA     NXQ,1                                                 LDS00570
      00107  0734 00 1 00000  00          PAX     ,1                                                    LDS00580
      00110 -3 00000 1 00102  010         TXL     NXQ,1,0           NO QUESTION                         LDS00590
      00111 -0754 00 0 00000  00          ZAC                                                           LDS00600
      00112  0621 00 0 00135  010         STA     LVL               SET SUBEX LEVEL                     LDS00610
      00113 -0130 00 0 00000  00          XCL                       SET TRUTH = FALSE                   LDS00620
```

35.-1

```
$PUNCH OBJECT
$COMPILE MAD
$
                                                          QCOMPO

MAD (20 MAY 1966 VERSION) PROGRAM LISTING ... ... ...

             QUESTION COMPILER FOR KAS'S SEARCHES OF NASA FILES

             TVW - THE CIMS GROUP, INC.

              PARAMETER XW(50), XL(300)
              PARAMETER XRQ(300)
              PARAMETER XQUES(2000), XCQA(150), XQA(800)
              PARAMETER RQBUFL(1000),QTBUFL(640),XTRQ(13800)
              PARAMETER PNEST(10)
              PROGRAM COMMON  ALLAGN,DTAP1,DTAP2,PRGTAP,RQTAP,QTAP,QATAP
            1  QMAX,DTPLST(31),DICT(4096),SCRMAX
              DIMENSION RQBUF(RQBUFL),QTBUF(QTBUFL)
              DIMENSION QBUF(80), QA(XQA)
              DIMENSION CQA(XCQA), L(XL)
              DIMENSION W(XW)
              DIMENSION RQ(XRQ)
              DIMENSION QDES(3)
              DIMENSION BCD(4)
              NORMAL MODE IS INTEGER
              BOOLEAN PFLAG, PNFG
              EXECUTE SETDS.(DICT(0))
              RQFIL=2
              QDFIL=1
              DTAP1=11
              DTAP2=9
              PRGTAP=2
              RQTAP=4
              QTAP=3
              QATAP=4
              OPNL.(QDFIL,QTAP,QTAP,QTBUF,QTBUFL,0,-2,4)
              OPNL.(RQFIL,RQTAP,RQTAP,RQBUF,RQBUFL,0,-2,0)
              TRIQ=0
              QNO = 0
              LXW = 0
              LXL = 0
              LXCQA = 0
              RPX = 0
              LXRQ = 0
              READ FORMAT $16A5*$, DTPLST...DTPLST(15)
              EXECUTE SETERR.(READ)
       READ
              READ FORMAT QH, NQ, QDES...QDES(2)
              VECTOR VALUES QH= $I5,T1,3A6*$
              WHENEVER NQ .E. 99999, TRANSFER TO SCRTMR
              WHENEVER TRIQ .G. XTRQ, TRANSFER TO TMNYQ
              BRQ = 1
              CARDK = 1
              QPT = 1
              RPK = 0
              PFLAG = 0B
              PNFG = 0B
       QMOR   READ FORMAT QF, QBUF(1)...QBUF(80)
```

```
QCM00010           302929   05/23/67      11 44 27.5 PM
QCM00020
01QCM00030

                   QCM00040
                   QCM00050
                   QCM00060
                   QCM00070
                   QCM00080       *001
                   QCM00090       *002
                   QCM00100       *003
                   QCM00110       *C04
                   QCM00120       *005
                   QCM00130       *006
                   QCM00140       *006
                   QCM00150       *007
                   QCM00160       *008
                   QCM00170       *009
                   QCM00180       *010
                   QCM00190       *011
                   QCM00200       *012
                   QCM00210       *013
                   QCM00220       *014
                   QCM00230       *015
                   QCM00240       *016
                   QCM00250       *017
                   QCM00260       *018
                   QCM00270       *019
                   QCM00280       *020
                   QCM00290       *021
                   QCM00300       *022
                   QCM00310       *023
                   QCM00320       *024
                   QCM00330       *025
                   QCM00340       *026
                   QCM00350       *027
                   QCM00360       *028
                   QCM00370       *029
                   QCM00380       *C30
                   QCM00390       *031
                   QCM00400       *032
                   QCM00410       *033
                   QCM00420       *034
                   QCM00430       *035
                   QCM00440       *036
                   QCM00450       *037
                   QCM00460       *038
                   QCM00470       *039
                   QCM00480       *040
                   QCM00490       *041
                   QCM00500       *042
                   QCM00510       *043
                   QCM00520       *044
                   QCM00530       *045
                   QCM00540       *046
                   QCM00550       *047
```

35-2

OPERATING INSTRUCTIONS

REFORMAT PROGRAM CONTROL CARDS

The Reformat Program requires a total of 7 Control Cards. These cards are of two types: option selection and tape specification.

Options

There are 3 options:

1) SYSOUT - Hardcopy output on system output tape,

2) PRIOUT - Hard copy output on private output tape, and

3) APPEND - Append the reformated output to some previous reformated output.

On any reformat run none, one, or any combination of two or these options may be exercised.

The method of selecting the options desired is as follows:

	Columns		
Gontrol Card 1	1-6	8-13	15-20
	OPTION	O1	O2

O1 and/or O2 may be:

SYSOUT, PRIOUT, APPEND, or blank.

Notes: The private output tape will be written in BCD, 556 BPI. It will contain 20 logical records per physical record with 132 characters per logical record. The first character of each logical record is to be interpreted as a carriage control character. The last physical record may contain fewer than 20 logical records. The tape will be terminated with 2 Tape Marks.

Exception reports, e. g., Kills, will continue to be reported on the system output. In Append mode the reformat output tape will be positioned in front of the first Tape Mark before writing the new reformated information.

Tape Specification

Each of the 3 files (NASA Input, Reformated Output, and Private Output) that the reformat program uses, or may use, requires two control cards. These control cards specify the logical tape drive number or numbers that will be used by the file and the Computing Center tape numbers of the sequence of tapes which comprise the file.

For example, if the NASA Input file is contained on tapes 1047, 1438 and 1132, in that order, and the file may use drives 10 (A5) and 4 (A4); the control cards would be:

```
DINPT1 b b b b 10 b b b b b 4 b b 1438 b b 1132
DINPT2
```

The reformated output is to be put on tape 1477 and the file may use drives 11 (B4) and 3 (B3).

```
SOTPT1 b b b b 11 b b b b b 3 b b 1477
SOTPT2
```

There will be no private output but we must give drive numbers.

```
POTPT1 b b b b 11 b b b b b 3 b b 1477
POTPT2
```

If two different drive numbers are given on the control card the program will use first one, then the other, thus allowing some overlap in tape changing. The first drive used will be the first one specified on the control card.

The program takes responsibility for communicating with the operator about tape mounting and changing; however, $$ cards must be used to inform the operator of all tapes to be used during the job and should indicate whether tapes are to be file protected or not. $NEEDS10, NEEDS11 must be supplied if these tape drives are used.

Notice that the tape specification cards imply the number of tapes (not drives) that are available. When the program encounters a blank tape number it assumes that no more tapes are available. On an input file this signals the end of the job. On an output file it signals an error condition and the job is aborted; therefore, it is crucial that enough output tapes be assigned to a file to hold all the information that will be written on that file.

Example run:

```
$$      The following tapes will be used
$$      A5, A4 - 1037, 1442, 1279, 1038
$$      B4, B3  - 1465, 1466
$$      Tapes on A5, A4 should be mounted
$$      with ring out
$$      Tapes on B4, B3 should be mounted
$$      with ring in
$$      Mount tape 1037 on A5
$$      Mount tape 1466 on B4
$       NEEDS 10, NEEDS 11, EXECUTE
   )
   )
   )    PROGRAM
   )
   )
$       DATA
        OPTION b APPEND b SYSOUT
        DINPT1 b b b b 10 b b b b b 4 b b 1037 b b 1442 b b 1279 b b 1038
        DINPT2
        SOTPT1 b b b b 11 b b b b b 3 b b 1465 b b 1466
        SOTPT2
        POTPT1 b b b b b 9 b b b b b 9
        POTPT2
```

SEARCH PROGRAM

Control Card

The search program takes reformated input from drives 11 (B4) and 9 (B5) in the tape sequence specified on the first data card. This data card contains up to 16 Computing Center tape numbers in the format (16A5). The occurrence of a blank tape number signals the end of input as in the reformat program.

The search program itself is contained on tape 2 (B2) as 3 separate core-loads.

Questions

The program uses the first 5 columns of each card as a question number. This number is read with an I5 rule which requires that columns 1-5 contain only blanks or digits. The occurrence of question number 99999 signals the end of questions.

Column 80 of each card serves as a continuation mark and a sequence number. If this column is non-blank, non-zero there are more cards for this question. In addition, this number is the sequential card number within the question. This implies a limit of 10 cards per question. (sequence numbers 1, 2, ..., 9, blank).

The first 18 columns of the first card of each question are read in alphabetic and are used as a header during the reporting of the documents which answered the question. Columns 6-18 are not used by the program for any other function.

Questions need not be in sort by question number, but within a question they must be in sort by sequence number.

DESCRIPTION OF THE RECORDS ON THE SEARCH AND RETROSPECTIVE TAPES

The physical record size is always less than or equal to 600 words. (These tapes are written in binary mode, high density-556 BPI). Since they were written by the 7090, the "word" on a tape record is a 36 bit word. There is a variable number of logical records on a physical record. They are written by laying down each logical record in a buffer 600 words long, until there is not enough room left for the next logical record. When we run out of room, we write the physical record and begin laying logical records down in the swing buffer. Thus each physical record begins with the beginning of a logical record.

The end of a logical reel of tape is indicated by two consecutive end-of-file marks. There are no end-of-file marks within the logical reel.

Format of a string of logical records within a physical record:

word 1	8		Count of words for this logical record (including this word)
word 2 . . . word 8		see description of logical record	This is the information retrieved by GETL. or stored by PUTL.
word 9	27		Count of words for this logical record (including this word)
word 10 . . . word 36		logical record	
. . .			
word n	0		This signifies that there are no more logical records in this physical record

Format of a logical record:

Location	Contents	Example
word 1	ISSUE	22 b b b b
word 2	YEAR	66 b b b b
word 3	A or N	A b b b b b
word 4	Accession #	A 1 2 3 4 5
word 5	n = Count of descriptors for this document	3
word 6	Descriptor 1	$Hash_1$
.	.	$Hash_2$
word 5 + n	Descriptor n	$Hash_3$

Descriptor #1 is always the Hash of the descriptor: CATEGORY n

The rest of the descriptors are the hash of all of the descriptors from the NASA tapes.

Since there is always at least one descriptor for a document (besides its category) and never more than 51 descriptors, we have created between 2 and 52 hash words. When we add in: the descriptor count, issue, year, letter, and accession number we wind up with a logical record which must be between 7 and 57 in length. Since each logical document is prefixed (within the physical record) with a word count, each logical record requires between 8 and 58 words to specify. Furthermore, since the average document seems to have about 20 descriptors, we find that the average logical record is about 27 words long. Thus we pack a little over 20 logical per physical (on the average)

APPENDIX 6

COMPUTERIZED REGIONAL DISSEMINATION CENTER MODEL RESULTS

One of the decision-making techniques which has been facilitated by the computer age is "Management by Exception". This technique calls for making management decisions only when certain predetermined processes, costs, volumes, etc. deviate by a given amount from a predetermined norm. At all other times, the system is permitted to function without constraints. The first step in implementing a "Management by Exception" operation is the delineation of the operations and variables which are involved in the given system. Such a program was initiated during the current year of operations at the KAS Center, involving an attempt to predict when self-support through non-NASA financing could be achieved. The expenses predicted on that level of operations would then serve as a norm.

In order to determine operating characteristics and parameters, an operational base line was selected at that point in time when the KAS Center had 60 fee-paying members, and was processing 967 profiles or questions on a monthly basis. (See Figure 6-1)

Following this analysis, a detailed investigation was conducted to determine such variables as full-time equivalents, salaries, equipment costs, travel fees, etc. which might be assigned to various job classification types. The personnel functions involved in the NASA Technology Transfer Program at Pitt were arranged into 16 categories, ranging from administrative through filing. An evaluation of the annual expenditures for these job types appears in Figure 6-2 ("Cost Figures for 60 Companies and 967 Questions by Job Type Classification").

Because the engineering activity in the NASA program, consisting of personal contact, consultation, question statement and review of computer outputs determines, to a great degree, what types of companies the Center ought to be attempting to attract, the engineering activity was broken out as a separate reporting function. Twenty-four substantive categories in which there was present or contemplated activity and/or capability were categorized, and the various individuals who functioned in an engineering capacity were classified accordingly. Using a predetermined maximum workload per engineering full-time equivalent, the number of future questions which the current engineering staff could evaluate without necessitating any increase in the number of personnel involved in this operation was developed. (See Figure 6-3, "Present and Future Engineering Consultant Capabilities")

Once the individual job type classification figures and the engineering capability figures had been generated, the next investigation identified the various costs which were involved in the NASA program. Three main topic areas, namely, sales-promotion, production, and management, were delineated. Once again, such categories as full-time equivalents, overhead, travel fees, rent, etc. were reported by the computer system for each of the above three categories. These figures are given in Figure 6-4, "Cost Figures for 60 Companies and 950 Questions by Endeavor Classification".

From these data, two averages were generated: (1) average cost per question per year with NASA support, and (2) average cost per question per year without NASA support. These averages are given in Figure 6-5, "The Following is a Summation of Costs of a NASA Regional Dissemination Center".

In addition to developing a "Management by Exception" reporting mechanism, the data were extrapolated in Figure 6-6 to predict volume of operations needed for achieving self-support. It should be noted that the predicted costs with increasing volume do not decrease linearly. Rather, at certain points (e.g., between 1100 and 1200 questions) per question, costs increase because additional personnel, machinery, office space, etc. must be added to the ongoing system. Consequently, while the data show an overall decrease in the per question cost as the volume of questions increases, there are certain points at which an increased volume of questions temporarily results in a higher per-question cost.

It will be noted that a minimum of about $150 per question (1 year current awareness service plus a retrospective search) was reached at about 2000 questions, or at about twice the number now serviced on a fee-paying basis. Accordingly, prices were increased 50% (from $100 to $150) while marketing efforts to attract new members were accelerated.

FIGURE 6-1

THE FOLLOWING IS AN ANALYSIS OF THE OPERATIONS OF THE KAS-NASA REGIONAL DISSEMINATION CENTER

ASSUMPTIONS FOR THIS RUN -

BASE NUMBER OF COMPANIES	60
NUMBER OF ADDITIONAL COMPANIES	0
TOTAL NUMBER OF COMPANIES	60
BASE NUMBER OF QUESTIONS	952
NUMBER OF ADDITIONAL QUESTIONS	0
TOTAL NUMBER OF QUESTIONS	952
COMPUTER COST/HOUR - IBM 7090	200.00
COST/XEROX COPY FOR DOCUMENTS	.06
COST/BRUNING COPY FOR ABSTRACTS	.02
COST/MICROFICHE BLOWBACK/FRAME	.09

FIGURE 6-2

COST FIGURES FOR 60 COMPANIES AND 967 QUESTIO

JOB TYPE	FULL-TIME EQUIVALENT	SALARY	OVERHEAD	FIXED EQUIP	RENTAL EQUIP	TRAVEL Costs
DOCUMENTALIST	.12	1620.00	902.34	.00	.00	450.00
FILE CLERK	1.22	3786.00	2108.80	379.00	169.00	.00
TYPIST	3.21	9764.00	5438.55	918.00	1587.00	.00
MACHINE OPERATOR	1.69	4962.00	2763.83	377.00	15564.00	.00
ANALYST	3.83	27751.00	15457.30	1239.00	.00	350.00
CONSULTANT	1.74	13217.00	7361.87	21.00	33.00	851.00
ADMINISTRATIVE	.09	1008.00	561.46	148.00	38.00	523.00
SECRETARIAL	1.51	5250.00	2924.25	854.00	1311.00	.00
SALES/PROMOTION	.85	11985.00	6675.64	692.00	.00	3708.00
INFORMATION ANALYST	.12	1330.00	740.81	36.00	45246.00	20.00
MAIL CLERK	.69	2139.00	1191.42	271.00	.00	.00
MESSENGER	.33	995.00	554.21	86.00	.00	.00
RECORD PROCESSING	.97	3861.00	2150.58	592.00	415.00	.00
MATERIALS SUPERVIS.	1.14	3784.00	2107.69	562.00	142.00	.00
PERSONNEL SUPERVIS.	1.15	4420.00	2461.94	666.00	168.00	23.00
GRADUATE ASSISTANT	.37	1588.00	884.52	.00	.00	.00

FIGURE 6-3

PRESENT AND FUTURE ENGINEERING CONSULTANT, CAPABILITIES

TYPE	FULL-TIME EQUIVALENT	PRESENT QUESTIONS	FUTURE (ADDITIONAL) QUESTION
CHEMICAL PROCESSING	.68	76	10
BIO-CHEMISTRY	1.28	168	67
POLYMER CHEMISTRY	.13	35	-5
HEALTH SCIENCES	.11	16	-6
REFRACTORIES,GLASS	.65	81	49
COMPUTERS/INFO. SCIENCES	.10	16	34
ELECTRONICS/COMMUNICATIONS	.03	19	6
METALLURGY	.16	154	14
EARTH SCIENCES/GEOLOGY	.08	36	0
THERMODYNAMIC ENGINEERING	.04	15	26
INSTRUMENTATION	.02	11	4
LUBRICATION/FLUIDS,FUELS	.02	19	1
ELECTRICITY	.03	19	6
NUCLEAR CHEMISTRY	.12	33	-3
OPTICS	.49	71	12
ACOUSTICS	.05	31	18
PLASMA PHYSICS	.02	19	6
MECHANICAL ENGINEERING	.12	52	26
VACUUM TECHNOLOGY	.30	12	14
OCEANOGRAPHY	.04	20	13
MATHEMATICS	.02	5	22
SPACE SCIENCES	.01	9	6
SOCIAL SCIENCES	.00	0	0
PHYS. CHEM. + METALLURGY	.10	50	12

FIGURE 6-4

COST FIGURES FOR 060 COMPANIES AND 0950 QUESTIONS BY ENDEAVOR

TYPE	FULL-TIME EQUIVALENT	SALARY	OVERHEAD	FIXED EQUIP	RENTAL EQUIP	TRAVEL FEES
SALES - PROMOTION	1.89	17711.00	9865.03	1067.00	340.00	3877.00
PRODUCTION	15.61	68277.00	38030.27	4966.00	64060.00	1009.00
MANAGEMENT	1.52	11364.00	6329.75	805.00	269.00	1039.00

THE FOLLOWING IS A SUMMATION OF COSTS FOR THE OPERATION OF A NASA RDC

NUMBER OF COMPANIES 60 NUMBER OF QUESTIONS 967

ANNUAL TOTALS

SALARIES	97460.00
OVERHEAD	54285.18
RENT EQU.	64673.00
SUPPLIES	9013.00
TRAVEL	5925.00
RENT	7454.00
COMMUNIC.	1689.00
PR/CONF.	406.00
1/5 FULL-TIME EQUIVALENT	1368.20
TOTAL	242273.38

AVERAGE COST/Q/YEAR+NASA -59.70

AVERAGE COST/Q/YEAR-NASA 250.54

FIGURE 6-6

PREDICTIONS FOR SELF SUPPORT BASED UPON NUMBERS OF PAYING QUESTIONS, AND COSTS PER QUESTION

QUESTIONS	COST PER QUESTION GROUP	COST PER QUESTION
10	90444.00	9044.40
100	99984.00	999.84
200	110584.00	552.92
300	121184.00	403.95
500	142384.00	284.77
1000	195384.00	195.38
1100	205984.00	187.26
1200	234811.00	195.68
1300	245411.00	188.78
1400	256011.00	182.86
1500	266611.00	177.74
1600	277211.00	173.26
1700	287811.00	169.30
1800	298411.00	165.78
1900	309011.00	162.64
2000	319611.00	159.81

APPENDIX 7

NORBATROL ELECTRONICS TRANSFER

norbaTROL
solid state controls

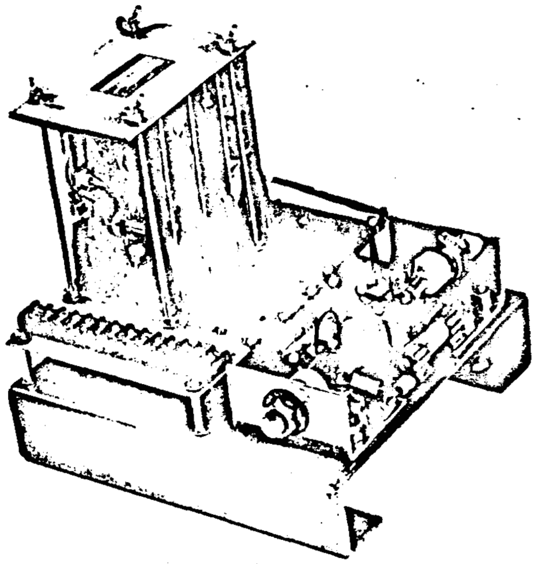
norbaTHERM™
non-indicating panels
temperature control system

technical bulletin no. 59-410

norbaTRŌL electronics corporation
356 collins avenue
pittsburgh, pennsylvania 15206
412/362-2020

NEW potentiometric control . . . completely solid state from thermocouple to load . . . no relays, contactors, electromechanical choppers or meter movements in the control circuit!

Fluidized Cooling



35 Amp – 240 Volt norbaTHERM™
Approx. 9" x 9" x 9"

exclusive norbaSINK™ safety features

This is norbaTRŌL's exclusive, unique, heat-dissipation construction employing a special new material which provides high thermal conductivity and eliminates the usually electrically hot, bulky, expensive, hazardous heat sinks (dissipators). norbaSINK feature means that the chassis or enclosure performs the function of heat sink, terminal block and mechanical chassis structure–all in one...yet electrical isolation is maintained!

Gone are all the insulating hardware-and-accompanying-failure/damage hazards, but a safe insulating base is retained.

norbaSINK's exciting breakthrough ushers in a new era of plant safety for maintenance men working on high power electrical equipment.

norbaTHERM benefits

- low initial equipment cost, competitive with systems using electro-mechaincal choppers or relays
- high reliability . . . maintenance associated with moving parts or electron tubes eliminated
- low operating cost . . . improved high power efficiency . . . absolute minimum of power loss
- potentiometric circuit assures accuracy and repeatability . . . eliminates loading the thermocouple or sensor
- performs the functions of a solid state control instrument and an SCR power pack . . . self-contained power control center

general norbaTHERM features

- stepless proportional band adjustment with a range of 20% of full span to a minimum of 2°C
- modular construction employs plug-in printed circuit boards, including thermocouple sensor, reference, proportioning circuit and power switch . . . all held rigidly in place
- both phase angle control and sub-second cycling available
- sub-second cycling provides true RMS power proportioning several times a second . . . duration of "power-on" and "power-off" periods varies with temperature control correction necessary
- output stage SCR's protected against overload by current limiting fuses . . . surge suppressors protect against voltage spikes . . . equipment rated to carry full load in 50°C ambient
- high power ratings up to 2000 KVA

norbaTRŌL
solid state controls

norbaRATIO™ pyrometer low temperature model

technical bulletin 59-204

norbaTRŌL electronics corporation
356 collins avenue
pittsburgh, pennsylvania 15206
412/362-2020

11285 -
Basic
Common
Building
Knoxville

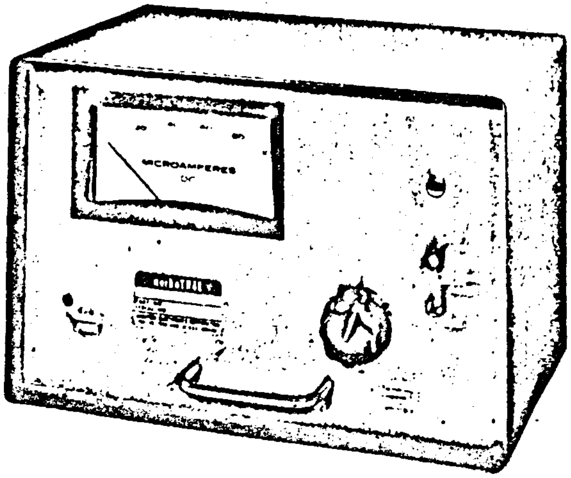
automatic non-contact ratio (two wavelength) temperature measurements

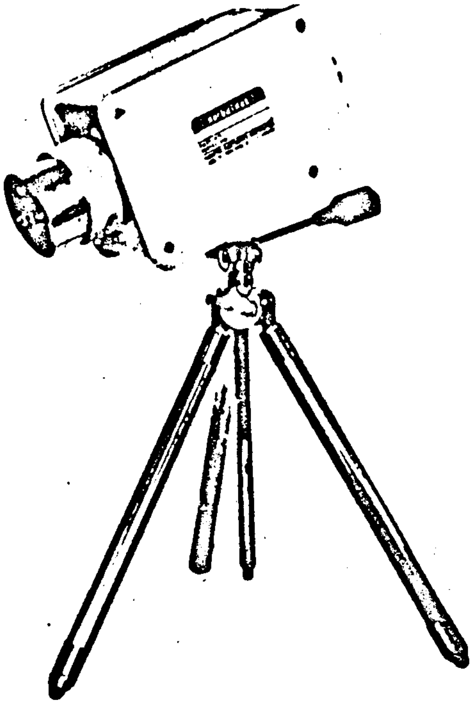
features

- cancels out emissivity effects
- reads through water, steam, vapors, sight glasses and haze
- built-in calibration check
- long term stability
- no motors or moving parts
- solid state detectors
- detector cooling not required
- unreliable high voltage circuits eliminated
- compact size and weight
- 5 minute warm up time
- low cost

applications

- **aluminum**; casting, extrusion and rolling
- **glass**; mold, float, stress, relieve and form
- **steel**; continuous anneal, preheat, coiler, galvanize, tin reflow, patent anneal, welding and finishing
- **non ferrous**; extrusion, rolling and casting





APPENDIX 8

SEMI-ELEMENTS TRANSFER

semi-elements, inc.
Saxonburg Boulevard, Saxonburg, Pa. 16056
Phone: 412-352-1548
TELEX 086-850

November 1, 1966

James P. Miller, Ph. D.
Associate Professor of Civil Engineering
The Knowledge Availability Systems Center
University of Pittsburgh
325 Engineering Hall
Pittsburgh, Pennsylvania 15213

Dear Dr. Miller:

Thank you for your letter of September 22 in regards to the NASA-Pitt Technology Transfer Program.

To summarize to date the usefulness of this program would be somewhat of a very volumous letter and rather than do this I would like to summarize some of the equipment we have made from the documentation we have received.

We have built a flame fusion apparatus from document No. N64-13720. This furnace has been quite successful and we are now going to build several of these furnaces for our production. The furnaces are capable of producing laser crystals of many types.

We have built an arc image furnace utilizing document No. N64-16326 and this furnace is not yet completed but well underway. This will expand our crystal growth technology into other areas such as controlled ferrites and controlled high temperature oxides where we can vary the stoichiometry of the crystals within the scope of the apparatus. We have obtained some information, however scantly on Czochralski growth of ruby single crystals from document N65-35419. However, the documents here were not too good in that too much material was missing from the documents and not even those that were skilled in the art could have made much use from these documents. However, on document A65-31368 we have made use on this document where it describes the cold crucible method of containing the material. Here we were able to apply this to single crystal growth and zone refined materials that normally react with crucibles.

Out of the other few hundred documents we have received, over 25% of them have been used at some time or another in looking up various characteristics of materials that we are currently producing and also making a study of these documents to determine new areas which our company will expand. Of the new areas, we are going to expend more time and effort in the ferrite field by utilizing single crystal ferrites. We also have been able to utilize many of the documents in our chemical processing facilities where these documents pointed out routes of more economical directions and more economical means of chemical production.

I would like to commend you on your work in the Knowledge Availability Systems Center on the fine job that is being carried out and I am sure that other members of this Center are likewise finding the information very useful and constructive.

If you have any questions concerning the above, please do not hesitate to contact me.

Yours very truly,

SEMI-ELEMENTS, INC.

Joseph V. Fisher
President

JF:dr

APPENDIX 9

OTHER DOCUMENTED TECHNOLOGY TRANSFERS

SUBJECT: Documented Technology Transfer

Individual Confidential

Company Confidential

Transfer Area Lubrication and functional fluids

Application Development of a new product based upon the document cited below

N64-26429 Monsanto Research Corp., Dayton, Ohio Dayton Lab.
DEVELOPMENT OF FIRE-RESISTANT WATER BASE HYDRAULIC FLUID
E. S. Blake, G. F. Deebel, and G. A. Richardson [1964] 16 p
(Contract NObs-90270)
(BR-1; AD-600703)

Partial alkyl ester alkali salts of phosphates and phosphonates are promising candidates as pour point depressants for fire-resistant, water-base hydraulic fluids. These compounds appear hydrolytically stable in alkaline solution at 200° F and possess high autoignition temperatures (AIT). The alkylphosphoramidates, because of their low AIT values, are of no value for this application. Mono-chlorination of an n-alkyl phosphate also makes no contribution to the AIT of the trialkyl ester. Water-soluble aromatic phosphates without hydrolytic stabilization are of no further interest. Author

Additional Comments "Even one abstract in a sheaf of 20 which triggers a request for a document constitutes a successful search." "On suspended programs, the system helps keep the staff abreast of current work in case it is to be picked up again."

SUBJECT: Documented Technology Transfers

<u>Individual</u> Confidential

<u>Company</u> Confidential

<u>Transfer Area</u> High Vacuum technology

<u>Application</u> Subject attended the Fall, 1965 Technology Utilization Conference at the Lewis Research Center, at the invitation of the KAS Center. At that conference he listened to a presentation on vacuum technology presented by a Lewis Center researcher. Unable to obtain information relevant to the maintainability of high vacuum equipment from other sources, subject contacted a Dr. Kaufman at the Lewis Research Center. He was then put in touch with individuals at Lewis who were working with high vacuum equipment, and who answered subjects questions adequately enough that the company has proceeded with the purchasing of high vacuum equipment for the vacuum deposition of protective thin films on steel substrates on a production basis.

SUBJECT: Documented Technology Transfers

Individual — Confidential

Company — Confidential

Transfer Area — Composite materials

Application — The following abstract directly solved a company problem relating to the determination of composite materials strength.

A65-26574 #

IMPACT FRACTURE TOUGHNESS AND OTHER PROPERTIES OF BRAZED METALLIC LAMINATES.

H. L. Leichter (California, University, Lawrence Radiation Laboratory, Livermore, Calif.).

American Institute of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, Colorado Springs, Colo., June 14-18, 1965, Paper 65-566. 20 p. 11 refs.

Members, $0.50; nonmembers, $1.00.

AEC Contract No. W-7405-eng-48.

Discussion of one of the primary causes of failure in high-strength structures - the propagation of internal flaws at stresses considerably below the yield strength of the structural material. Since it is virtually impossible to build an engineering structure without defects, the material must possess sufficient toughness to tolerate imperfections. Fracture toughness (the ability of material to resist crack propagation) is a property dependent upon a number of variables. Other conditions remaining constant, the fracture toughness of a metal reaches an optimum at a thickness of about .05 to 0.2 in. and then decreases rapidly with further increase in thickness, approaching a minimum value asymptotically, representing 100% plane strain fracture. This behavior suggested that metallic laminates composed of brazed sheets, near optimum thickness, may exhibit higher toughness than a homogeneous specimen of the same thickness. Brazed laminates of maraging steels and also titanium 5Al-2.5Sn have been investigated. Some of these exhibited fracture toughness values from 2 to 7.8 times that of solid specimens of the same alloy and thickness. Data are presented over a temperature range of -320°F to 600°F. The laminates retain essentially the same tensile properties as the base metal, and preliminary fatigue tests appear promising.

(Author) W.M.R.

Additional Comments — "I got a couple of gems from your system I wouldn't have gotten from other sources." (follow-up investigation verified that subject was referring to only one abstract, A65-26574)

SUBJECT: Documented Technology Transfer

Individual: Confidential

Company: Confidential

Transfer Area: Residual stresses in metals

Application: "Two NASA documents, one a translation of a Russian paper, the other a government report, answered 100% the problem we had."

N64-11784 Joint Publications Research Service, Washington, D.C.
X-RAY DIFFRACTION ANALYSIS OF THE FIRST ORDER RESIDUAL STRESSES WHICH APPEAR DURING FINE MACHINING OF METALS
A. V. Poltavskiy and Yu. S. Terminazov 16 Dec. 1963 9 p refs Transl. into ENGLISH of an article from Izv. Akad. Nauk Kirg. SSR, Ser. Estestv. i Tekhn. Nauk (Alma Ata), v. 1, no. 3, 1959 p 45–50
(JPRS-22306; OTS-64-21033) OTS: $0.50

First order residual stresses in the surface layer of Steel 40, subjected to fine machining, were investigated by X-ray diffraction. Results indicate: (1) Fine machining caused the appearance of compressive first order residual stresses in the surface layer of the steel. (2) An increase in the rate of machining reduced the first order residual stresses; however, a tendency toward stabilization of the first order residual stresses was observed as the rate of machining increased. (3) Increasing the depth of cutting caused appreciable reduction of the stresses under consideration. (4) The delivery of the machining (in mm/rev) does not exert the same influence on the first order residual stresses. (5) All the parameters of fine machining considered exerted a vital influence on the magnitude of the compressive first order residual stresses.

I.v.L.

N65-33876*# Battelle Memorial Inst., Columbus, Ohio.
NONDESTRUCTIVE MEASUREMENT OF RESIDUAL STRESSES IN METALS AND METAL STRUCTURES
Koichi Masubuchi Huntsville, Ala., Army Missile Command. Apr. 1965 141 p
(Contract DA-01-021-AMC-11706(Z))
(NASA-CR-64918; RSIC-410) CFSTI: HC $4.00/MF $1.00 CSCL 11F

This report presents a state-of-the-art survey of the nondestructive measurement and evaluation of residual stresses produced in metals and metal structures. The report is concerned primarily with residual stresses produced during the fabrication of structures made of high-strength aluminum alloys. Discussions are presented in four sections which provide the following: (1) fundamental information on residual stresses that is needed to understand measurement techniques; (2) review of methods of measuring residual stresses, including stress-relaxation techniques, X-ray diffraction technique, the ultrasonic technique, the hardness technique, and cracking techniques; (3) measurement of residual stresses during fabrication of metal structures (methods of measuring residual stresses and typical experimental data are described), and (4) selection and use of appropriate measurement techniques and evaluation of results.

Author

Additional Comments: ASM abstracts are inferior to NASA's. The probability of finding applicability in "A" is higher than in "N". On the other hand, for specifity, "N" provides better information.

SUBJECT: Documented Technology Transfer

Individual: Confidential

Company: Confidential

Transfer Area: Electron microprobe analysis

Application: "I have been working in this field for 3½ years and I have not seen any of these abstracts which you have sent me. I feel I am 2 years ahead of myself thanks to your system. It would have taken 2 years getting to the point I an now in in 2 months."

N65-14870# Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.
MICROPROBE STUDY OF ZIRCALOY CORROSION FILMS
Kurt F. J. Heinrich Nov. 1964 46 p refs
(Contract AT(07-2)-1)
(DP-906) OTS: $2.00

The primary object of this study was to determine the potential usefulness of the electron probe analyzer as a tool for the investigation and elucidation of problems in the corrosion of zirconium alloys, particularly Zircaloy-2. The general applicability of the probe to corrosion studies was demonstrated. Techniques were developed for the preparation and study of corroded zirconium alloy specimens. Previously unknown characteristics of the distribution of the component elements were revealed in Zircaloy-2 specimens and other zirconium alloys which had been subjected to various heat treatments. Data were also obtained on the composition and distribution of alloy elements in the fundamental corrosion layers. The possible significance of these findings is discussed in the light of current theories on corrosion mechanisms in zirconium alloys. Author

Additional Comments: "N65-14870 the author is a personal friend of mine and I did not know he had written this paper."

SUBJECT: Documented Technology Transferring

Individual Confidential

Company Confidential

Transfer Area Materials damping

Application This NASA document dealing with material damping has been of direct applicability without transposition.

A64-15176
EXPERIMENTAL STUDY OF DILATATIONAL- VERSUS DISTORTIONAL-STRAINING ACTION IN MATERIAL-DAMPING PRODUCTION.
T. J. Mentel and S. H. Chi (Minnesota, University, Dept. of Aeronautics and Engineering Mechanics, Minneapolis, Minn.).
Acoustical Society of America, Journal, vol. 36, Feb. 1964, p. 357-365.
Contract No. AF 33(616)-5828.

Experimental study of cyclic material damping in thin-walled, cylindrical specimens of manganese-copper alloy, subject to combined axial- and internal pressure loading. Tests were carried out on a number of manganese-copper alloy specimens for which the usual uniaxial, cyclic-stress, damping properties had already been established (and published). The new tests extended the ratio of dilatational- to distortional-strain energies from the fraction that occurs under uniaxial stress up to the maximum factor of about 2/3, which is possible under biaxial stress. The results display a small but definite contribution to the material damping by the dilatational-straining action. As a consequence, a modified formula is suggested for the specification of material damping in plate vibrations.

Additional Comments "The service is perfect. We get the best of the advanced techniques and we rework the materials to fit (our needs)."

SUBJECT: Documented Technology Transfer

Individual Confidential

Company Confidential

Transfer Area Thermocouple ranges and atmospheres

Application Two cited abstracts directly relevant to and applied to the problem area

14
N65-30297# Columbia Univ. New York Plasma Engineering Lab
TEMPERATURE DETERMINATION IN MODERATELY DENSE, HIGH-TEMPERATURE GASES BY TRANSIENT THERMOCOUPLE PROBES Interim Technical Report
P S Tschang Wright-Patterson AFB, Ohio, ARL. May 1965
39 p refs
(Contracts AF 33(615)-1141, AF 49(638)-1395)
(ARL-65-95, AD-617702)

A study has been made to determine the bases of the transient methods of the single probe the dual-probe, and the intermittent probe for measuring high gas temperatures. Simple parameters critically affecting the probe accuracies have been singled out for comparing the relative merits of the methods under scrutiny. The results indicate no fundamental superiority of any one technique, but in practice the single probe seems most likely to attain the theoretical accuracy by virtue of its simplicity of implementation. The analyses indicate the need to take the variation of all probing parameters into account because of the tendency for these effects to be magnified into large errors resulting in inaccurate gas temperature determination. A novel three-terminal low noise thermocouple sensing element is presented together with its performance in an arc plasma environment. Author

A65-15775
TEMPERATURE MEASUREMENTS IN THE 3000°F TO 5000°F RANGE USING RIBBON THERMOCOUPLES.
Jacob Nanigian (Nanmac Corp., Needham, Mass.).
Instrument Society of America, Annual Conference, 19th, New York, N.Y., Oct. 19, 1964, Paper. 12 p. 7 refs.

Description of the design of ribbon-element thermocouples capable of continuous operation even while subjected to erosion and ablation. Case histories of applications in the high temperature range are presented, together with temperature-time graphs. Applications above the 3000°F range include rocket nozzle inner surface temperatures, rocket combustion temperatures, hot gas hydrogen chambers, graphite furnaces, and materials evaluation for heat protection shields. Thermocouple characteristics such as cycling, reproducibility, response time, and durability at sustained high temperatures are discussed. F.R.L.

Additional Comments "Abstracts give me a good idea of the content of the document."

SUBJECT: Documented Technology Transfer

Individual Confidential

Company Confidential

Transfer Area Cutting of continuous cast steel

Application The report relating to the investigation in question has been classified as "Company Confidential" with in the company. However, notification has been received that innovation in question resulted from the application of a gas synamics-nozzle exhaust abstract and document which were culled from the NASA retrieval system at Pitt. The problem dealt with the wearing out of the saw blades which were being utilized to cut predetermined lengths of steel during the continuous casting operation. Through the bridging of the exhaust nozzle and the steel cutting operations, the problem has been eliminated, and a novel saw blade has been developed which has long life and is easy to produce.

APPENDIX 10

EXAMPLE INFORMATION SCIENCE PROGRAMS

AT THE KAS CENTER

INFORMATION SCIENCE PROGRAMS AT KASC

RESEARCH

NAME	SPONSOR	OTHER SCHOOLS INVOLVED	STATUS
Relevance Predictability	NIH	School of Medicine -20 Faculty School of Education -2 Faculty -1 PhD Candidate	On-going-2½ yrs.
Information Systems Testing & Evaluation	DIA	Department of Computer Sciences -1 Faculty	On-going-1 yr.
.Man-Machine Interaction in I.R.	ONR	Department of Computer Sciences	On-going-2 wks.
Paint Thesaurus Development	Federation of Paint Technology Societies	-------------	On-going-9 mos.
Novel Class Scheduling Approach	OE	-------------	Completed (2yr. Program)
Information System in Industrial Hygiene	Mellon Institute	Mellon Institute -1 Senior Fellow -1 Staff Member	On-going-3 mos.
International Dimensions in Information Science	Ford Foundation	School of Education -1 Faculty -1 Staff	On-going-2 mos.

INFORMATION SCIENCE PROGRAMS AT KASC

OTHER ACTIVITIES

NAME	SPONSOR	OTHER SCHOOLS INVOLVED	STATUS
Encyclopedia of Library and Information Science	Marcel Dekker Inc.	GSLIS -Dean University Libraries -Director	On-going-1½ yrs.
Conferences on Electronic Information Handling I. Oct. 1964	Western Michigan Univ., Goodyear Aerospace Corp.	Computer Science Dept. -Chairman Industrial Engineering Department -Chairman Sociology Department -Chairman	Completed
II. April, 1967	ONR, ACM Western Michigan Univ., Goodyear Aerospace Corp.	Computer Science Dept. -Chairman Industrial Engineering Department -Chairman	Completed
Conference on Library Planning for Automation (June, 1964)	Council on Library Resources	-------------------	Completed
Survey of Specialized Information Centers	University of Pittsburgh	-------------------	Completed
Task Force on Information Networks	EDUCOM	-------------------	On-going-2 yrs.
Center for Biomedical Communications Research	Excerpta Medica Foundation	School of Medicine	On-going-1½ yrs.